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(54) **POWER GENERATOR POWER GENERATION FACILITY**

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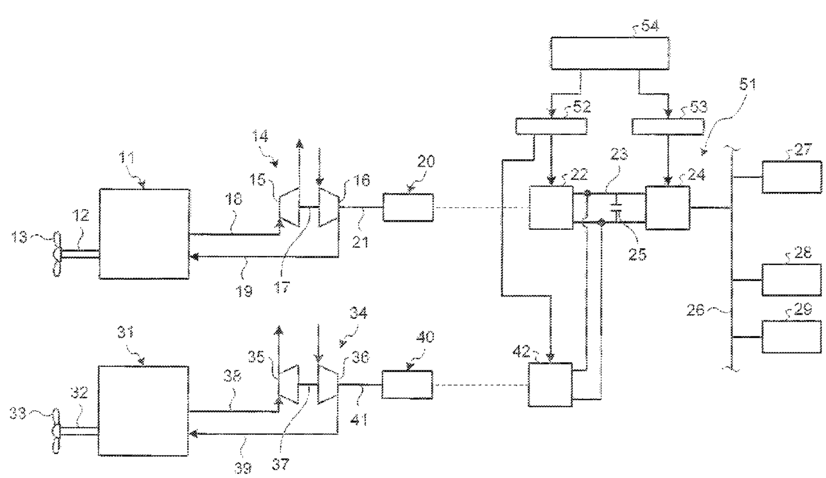
(57) **ABSTRACT**

In a power generation facility, there are provided a plurality of diesel engines, a plurality of turbochargers driven by exhaust gas from the diesel engines, a plurality of power generators connected to the plurality of turbochargers, a plurality of converters for converting AC power generated by the plurality of power generators to DC power, one inverter for converting the DC power outputted from the plurality of converters to AC power, and a main controller for controlling the converters in accordance with the AC power from the inverter, by which stable electric power can be generated.

3 Claims, 3 Drawing Sheets



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F02B 37/24	(2006.01)
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H02K 1/12	(2006.01)
H02K 1/27	(2006.01)
F02B 37/12	(2006.01)

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FIG. 1

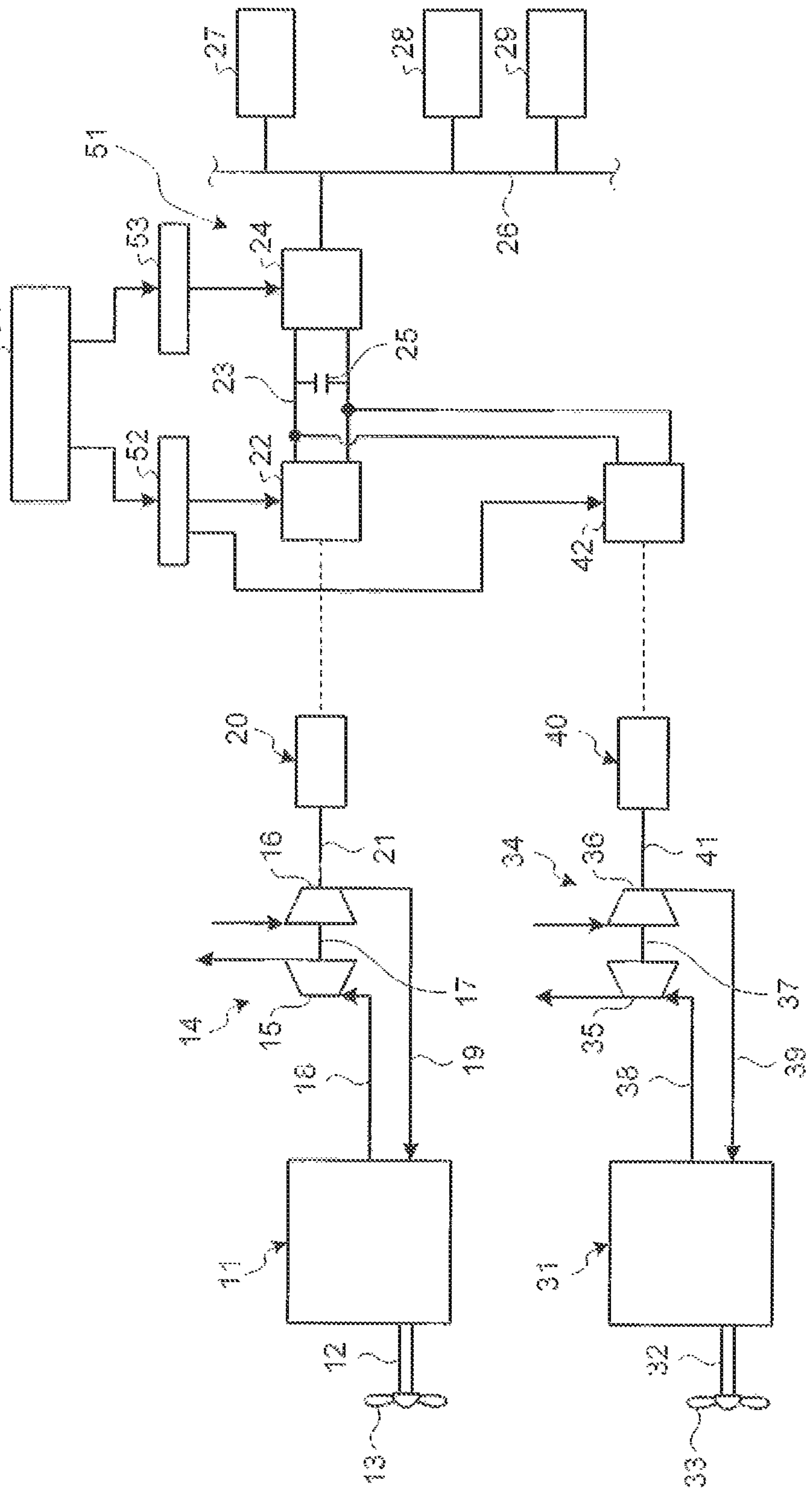

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FIG.2

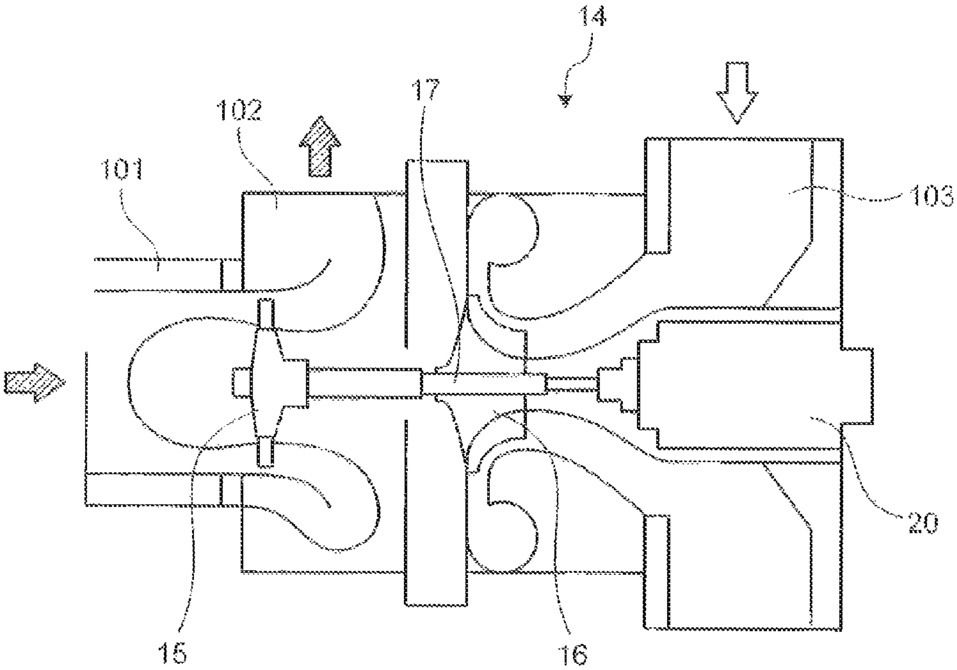
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FIG.3

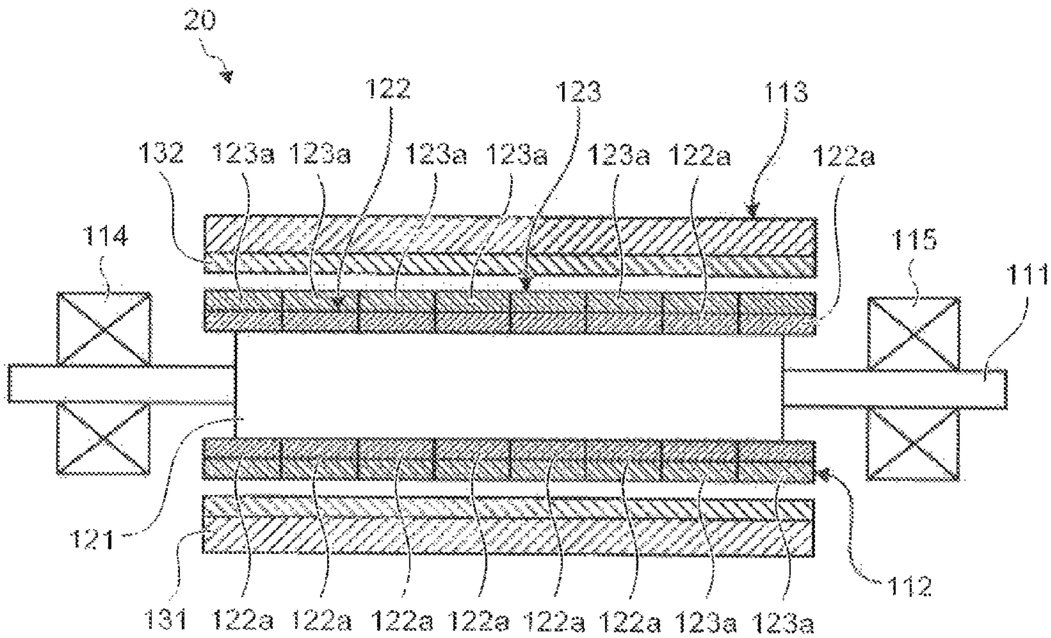
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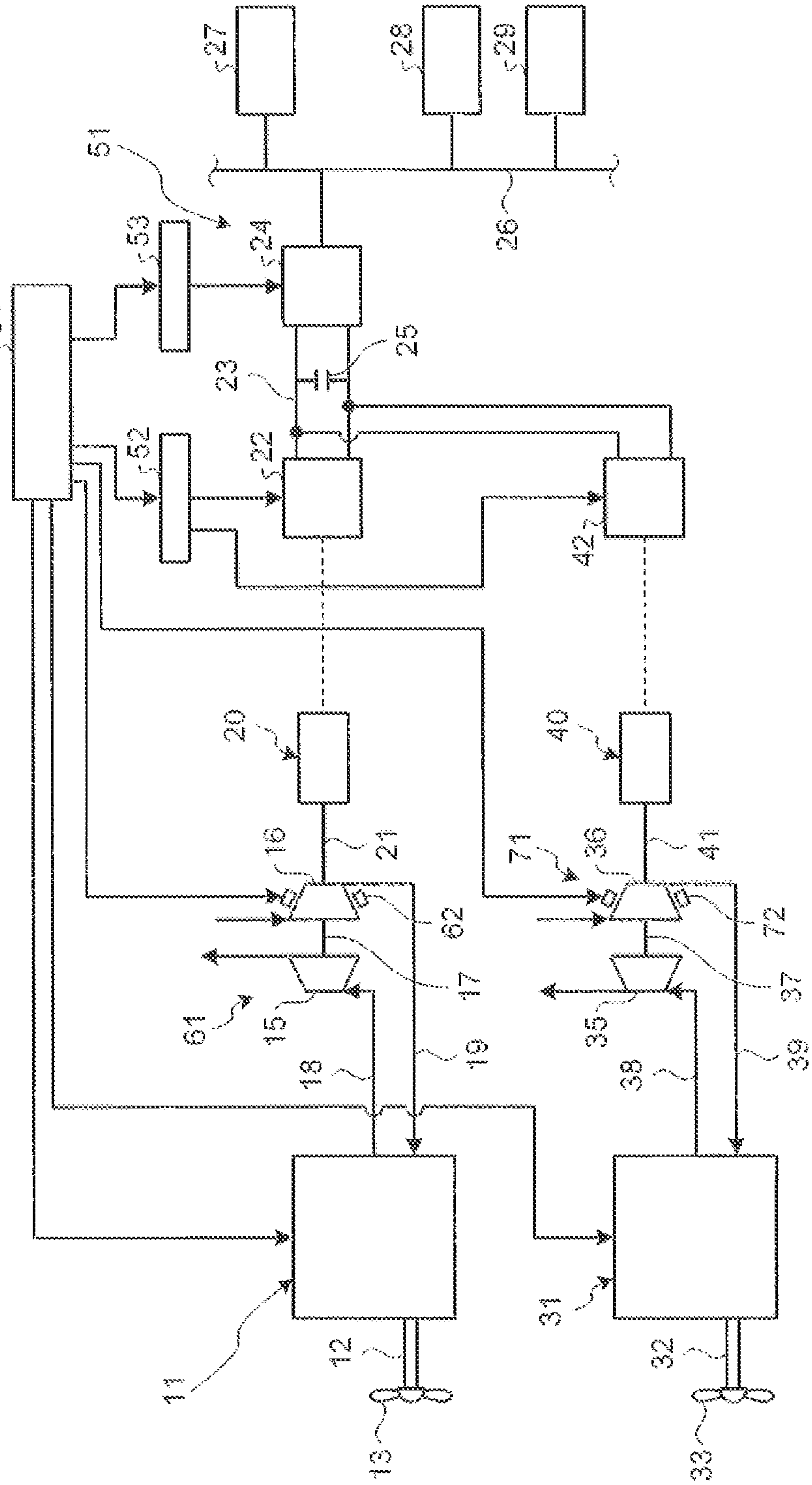
FIG.4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POWER GENERATOR POWER GENERATION FACILITY

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates to a power generator to generate electric power, and a power generation facility mounted on a vessel, and a power generation facility that controls power generation by a plurality of power generators connected to a plurality of turbochargers.

2. Description of the Related Art

For example, on a vessel, a plurality of diesel engines are mounted for propulsion, and these diesel engines each have a turbocharger (supercharger). In view of energy saving, a power generator has been considered, wherein a power generator that collects energy of exhaust gas as electric power is connected to at least one of the plurality of turbochargers.

For example, in a supercharging device described in Japanese Laid-open Patent Publication No. 2009-257098, an exhaust gas turbine turbocharger, which is in a parallel running state to a exhaust gas turbine turbocharger during engine operation, is provided, a power generator is mounted on the exhaust gas turbine turbocharger, and a power generation amount of the power generator is controlled so that a rotation speed of the exhaust gas turbine turbocharger matches a rotation speed of the exhaust gas turbine turbocharger. Moreover, in a design and a manufacturing method of a power generator described in Japanese Patent No. 3699134, not by changing a diameter of a given traverse section but by adjusting a length of the given traverse section, the power generators having the same traverse section diameter are designed and manufactured, which enables standardization of various parts to be achieved. Moreover, an electric power converting device described in Japanese Laid-open Patent Publication No. 2003-009537 is configured so that a plurality of power generators are connected on DC through a booster circuit and a backflow prevention diode and electric power is supplied to an electric power system by one inverter.

SUMMARY OF THE INVENTION

1. Technical Problem

In JP 2009-257098 and JP 3699134 described above, the power generator applied to the exhaust gas turbine turbocharger, the design and the manufacturing method of the power generator are described. However, in the above-described power generator, although by adjusting the length of the given traverse section, the power generators having the same traverse section diameter can be designed and manufactured, thereby enabling the standardization of the various parts to be achieved, sufficient standardization has not yet been achieved.

Moreover, in the above-described publications, the techniques of controlling the power generation amount of the power generator so that the rotation speed of the exhaust gas turbine turbocharger matches the rotation speed of the exhaust gas turbine turbocharger and connecting the plurality of power generators on DC through the booting circuit and the backflow prevention diode to control the same by the one inverter are described. Since the plurality of diesel engines vary the rotation speed, it is difficult to assure the stable power generation amount.

The present invention was devised to solve the above-described problems, and an object thereof is to provide a power generator and a power generation facility that enables low cost by achieving standardization of various components. Another object of the present invention is to provide a power generation facility capable of generating stable electric power.

2. Solution to the Problem

According to a power generation facility of the present invention in order to achieve the object, the power generation facility includes: a plurality of exhaust gas generating sources; a plurality of turbochargers driven by exhaust gas from the plurality of exhaust gas generating sources; a plurality of power generators connected to the plurality of turbochargers; a plurality of converters that convert AC power generated by the plurality of power generators to DC power; one inverter that converts the DC power outputted from the plurality of converters to AC power; and a control device that controls the plurality of exhaust gas generating sources or the plurality of turbochargers in accordance with the AC power from the inverter.

Accordingly, the plurality of exhaust gas generating sources or the plurality of turbochargers are controlled so that the AC power from the inverter becomes desired electric power, by which stable electric power can be generated.

According to the power generation facility of the present invention, the plurality of exhaust gas generating sources are engines, and the control device controls the engines so that the AC power from the inverter becomes constant.

Accordingly, by controlling an intake air amount, a fuel supply amount, ignition timing, the rotation speed and the like, stable electric power can be generated.

According to the power generation facility of the present invention, the plurality of turbochargers are variable capacity type turbochargers, and the control device controls supercharging pressure in the turbochargers so that the AC power from the inverter becomes constant.

Accordingly, by adjusting a exhaust gas amount, flow velocity and the like in the variable capacity type turbochargers to control the supercharging pressure, the stable electric power can be generated.

According to the power generator of the present invention, the power generator includes: a rotary shaft; a rotor fixed to the rotary shaft; and a stator provided outside the rotor, wherein the rotor has: an iron core fixed to the rotary shaft; a magnet fixed to an outer circumferential surface of the iron core and axially divided into a plurality of pieces; and a retaining ring arranged on an outer circumferential surface of the magnet and axially divided into a plurality of pieces.

Accordingly, the magnet and the retaining ring making up the rotor are constructed by being axially divided into the plurality of pieces, and thereby, in accordance with a required specification of the power generator, outer diameters of the magnet and the retaining ring are uniform, and on the other hand, axial lengths only needs to be set, using predetermined numbers of the divided pieces, so that the standardization of the various components can be achieved, thereby enabling low cost.

According to the power generator of the present invention, the magnet has a ring shape or an arch shape, and has the divided pieces of a same outer diameter and a same axial length, and the retaining ring has a ring shape, has the divided pieces of a same outer diameter and a same axial length, and is fitted and fixed onto the outer circumferential surface of the magnet.

Accordingly, the magnet and the retaining ring making up the rotor are constructed by lining up the plurality of pieces having the same length, and thereby, the numbers thereof only need to be set in accordance with the required specification of the power generator, so that the standardization of the various components can be achieved, thereby enabling low cost.

According to the power generator of the present invention, between the magnet and the retaining ring, division positions in an axial direction are different.

Accordingly, in the division positions of the retaining ring are made different from the division positions of the magnet, which enables robust fixing of the magnet by the retaining ring.

According to the power generator of the present invention, the stator has an iron core axially divided into a plurality of pieces and having a ring shape, and a coil wound around the iron core.

Accordingly, not only the rotor but also the iron core of the stator is axially divided into the plurality of pieces to be constructed, by which in accordance with the required specification of the power generator, an outer diameter of the iron core is uniform, and on the other hand, a number of the divided pieces only needs to be a predetermined number to set an axial length, so that the standardization of the various components can be achieved, thereby enabling low cost. Moreover, since the iron core of the stator is formed of a thin layered steel plate, the above-described axial length setting is easy.

According to the power generation facility of the present invention, the power generation facility includes: a plurality of exhaust gas generating sources; a plurality of turbochargers driven by exhaust gas from the plurality of exhaust gas generating sources; a plurality of power generators connected to the plurality of turbochargers; a plurality of converters that convert AC power generated by the plurality of power generators to DC power; and one or plurality of inverters that convert the DC power outputted from the plurality of converters to AC power; each of the power generators including: a power generator rotary shaft directly connected to a rotary shaft of each of the turbochargers; a rotor fixed to the power generator rotary shaft; and a stator provided outside the rotor, wherein the rotor has: an iron core fixed to the rotary shaft; a magnet fixed to an outer circumferential surface of the iron core and axially divided into a plurality of pieces; and a retaining ring arranged on an outer circumferential surface of the magnet and axially divided into a plurality of pieces.

Accordingly, the magnet and the retaining ring making up the rotor in the power generator are constructed by being axially divided into the plurality of pieces, by which in accordance with a required specification of the power generator, outer diameters of the magnet and the retaining ring are uniform, and on the other hand, axial lengths only need to be set, using predetermined numbers of the divided pieces, so that the standardization of the various components can be achieved, thereby enabling low cost.

3. Advantageous Effects of Invention

According to the power generation facility of the present invention, the plurality of turbochargers driven by the exhaust gas from the plurality of exhaust gas generating sources are provided, and the plurality of power generators are connected to these respective turbochargers, and further the plurality of converters that convert the AC power generated by the plurality of power generators to the DC power, the one inverter that converts this DC power to the AC power, and the control device that controls the plurality of exhaust gas generating sources or the plurality of turbochargers in accordance with the AC power from the inverter are provided, which enables the stable electric power to be generated.

Moreover, according to the power generator or the power generation facility of the present invention, the magnet and the retaining ring making up the rotor in the power generator are constructed by being axially divided into the plurality of pieces, so that the standardization of the various components are achieved, thereby enabling low cost.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic configuration diagram of a power generation facility to which a power generator according to a first embodiment of the present invention is applied.

FIG. **2** is a schematic diagram of a turbocharger on which the power generator of the first embodiment is mounted.

FIG. **3** is a cross-sectional diagram of the power generator of the first embodiment.

FIG. **4** is a schematic configuration diagram of a power generation facility to which a power generator according to a second embodiment of the present invention is applied.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, referring to the accompanying drawings, preferred embodiments of a power generator and a power generation facility according to the present invention will be described in detail. These embodiments do not limit the present invention, and when there is a plurality of embodiments, the present invention includes an embodiment obtained by combining the respective embodiments.

First Embodiment

FIG. **1** is a schematic configuration diagram of a power generation facility to which a power generator according to a first embodiment of the present invention is applied, FIG. **2** is a schematic diagram of a turbocharger on which the power generator of the first embodiment is mounted, and FIG. **3** is a cross-sectional diagram of the power generator of the first embodiment.

The power generation facility of the first embodiment is mounted on a vessel (not shown). As illustrated in FIG. **1**, two diesel engines (exhaust gas generating sources) **11**, **31** are driven, using heavy oil as fuel, and function to propel the vessel. That is, in the respective diesel engines **11**, **31**, propeller shafts **12**, **32** are connected to crankshafts (not shown), and screw propellers **13**, **33** are attached to the propeller shafts **12**, **32**.

Two turbochargers **14**, **34** are mounted on the respective diesel engines **11**, **31**, and are constructed by connecting turbines **15**, **35** and compressors **16**, **36** via rotary shafts **17**, **37**. Accordingly, in the respective turbochargers **14**, **34**, when the respective turbines **15**, **35** are rotated by exhaust gas exhausted from exhaust passages **18**, **38** of the respective diesel engines **11**, **31**, the respective compressors **16**, **36** connected via the rotary shafts **17**, **37** are rotated to thereby perform supercharging, which enables the air to be sent into intake passages **19**, **39** of the respective diesel engines **11**, **31**.

The respective turbochargers **14**, **34** have power generators **20**, **40** coaxially connected thereto. In these power generators **20**, **40**, rotary shafts **21**, **41** thereof are directly connected to the rotary shafts **17**, **37** of the respective turbochargers **14**, **34**. Accordingly, when the respective turbochargers **14**, **34** are driven, the respective power generators **20**, **40** can output AC power.

An electric power converter **51** rectifies and outputs electric power generated by the respective power generators **20**, **40**, and has converters **22**, **42**, a DC link **23**, and an inverter **24**.

That is, the converters **22**, **42** are connected to the power generators **20**, **40** to rectify the AC power outputted by these power generators **20**, **40** and convert the same to DC power. Moreover, the converters **22**, **42** are connected to the inverter **24** through the DC link **23**, and in the DC link **23**, a capacitor **25** is provided. The DC link **23** can charge the DC power converted by the converters **22**, **42** to output the DC power stored in the capacitor **25** to the inverter **24**. The inverter **24** converts the DC power converted by the converters **22**, **42** to predetermined AC power (e.g., 60 Hz, 450 V).

In this case, the electric power converter **51** rectifies and outputs the electric power generated by the two power generators **20**, **40**, and the two converters **22**, **42** are connected to the one inverter **24** through the DC link **23**. The inverter **24** is connected to an output system **26**, to which a plurality of auxiliary machines **27**, **28**, **29**, . . . are connected.

A converter controller **52** can control the respective converters **22**, **42**, and an inverter controller **53** can control the inverter **24**. A main controller **54** can control the converter controller **52** and the inverter controller **53**.

Accordingly, the main controller **54** outputs a DC bus voltage command to the converter controller **52**, and outputs a power generation output command to the inverter controller **53**. Here, while the inverter controller **53** performs control of the electric power outputted by the inverter **24**, based on the power generation output command from the main controller **54**, the converter controller **52** controls the respective converters **22**, **42** so that a DC bus voltage becomes constant because the electric power from the two converters **22**, **42** is supplied to the inverter **24**.

The converter controller **52** can perform power generation output control, output torque control, rotation number control over the respective converters **22**, **42**. Here, the converter controller **52** controls the respective converters **22**, **42**, for example, so that the power generation output is larger with respect to the power generator **20** or **40** having the higher rotation speed. That is, the converter controller **52** decreases a command rotation number or increases a command torque to the converter on the power generator side having the higher rotation speed. Moreover, the converter controller **52** controls the respective converters **22**, **42**, for example, so that the power generation output is larger with respect to the power generator **20** or **40** having the smaller torque. That is, the converter controller **52** decreases the command rotation number or increases the command torque to the converter on the power generator side having the smaller torque.

In this case, the respective converters **22**, **42** are in a voltage PWM format, and a backflow prevention diode is arranged between a DC bus and themselves to prevent lateral flow between the converters **22**, **42** arranged in parallel. However, as long as the converter controller **52** can control the respective converters **22**, **42** with high accuracy, this backflow prevention diode is unnecessary.

That is, in the present embodiment, the main controller **54** controls the converters **22**, **42** in accordance with the AC power outputted from the inverter **24**. That is, the main controller **54** controls the converters **22**, **42** so that the AC power outputted from the inverter **24** becomes almost constant.

Here, while details of the turbochargers **14**, **34** and the power generators **20**, **40** of the present embodiment will be described, these turbochargers **14**, **34** and the power generators **20**, **40** have almost similar configurations, and only the turbocharger **14** and the power generator **20** will be described.

In the turbocharger **14**, as illustrated in FIG. **2**, the rotary shaft **17** is rotatably supported at a central portion of a casing **101**, the turbine **15** is fixed at one end portion of this rotary shaft **17** integrally rotatably, and the compressor **16** can be fixed integrally rotatably at an intermediate portion. Moreover, in the casing **101**, a exhaust gas passage **102** is formed at one end portion, and an upstream side of this exhaust gas passage **102** is connected to the diesel engine **11** (refer to FIG. **1**) through the exhaust passage **18**. Furthermore, in the casing **101**, an intake gas passage **103** is formed at another end portion, and a downstream side of this intake gas passage **103** is connected to the diesel engine **11** (refer to FIG. **1**) through the intake passage **19**.

Moreover, the power generator **20** is arranged at the other end portion of the casing **101** on a shaft center side with respect to the intake gas passage **103**. This power generator **20** has a rotation center coaxial with the rotary shaft **17**, and a rotary shaft (power generator rotary shaft) **111** is directly connected to the rotary shaft **17** of the turbocharger **14** through the rotary shaft **21** to be able to rotate integrally.

As illustrated in FIG. **3**, this power generator **20** is made up of the rotary shaft **111**, a rotor **112** fixed to this rotary shaft **111**, and a stator **113** provided outside this rotor **112**. The rotary shaft **111** is rotatably supported by bearings **114**, **115** in the casing **101** of the power generator **20** to be connected directly to the rotary shaft **17**.

In this power generator **20**, the rotor **112** is made up of an iron core **121** fixed to the rotary shaft **111**, a magnet **122**, which is fixed to an outer circumferential surface of this iron core **121** and is axially divided into a plurality of pieces, and a retaining ring **123**, which is arranged on an outer circumferential surface of this magnet **122** and is axially divided into a plurality of pieces.

That is, the iron core **121** has a cylindrical shape, and is pressed onto an outer circumferential surface of the rotary shaft **111** to be integrally fixed. In this case, the rotary shaft **111** and the iron core **121** may be integrally formed. The magnet **122** is made up of a plurality of (in the present embodiment, 8) magnet pieces **122***a* each having the same shape. Each of these magnet pieces **122***a* has a ring shape (or an arch shape), is set to have a predetermined outer diameter and a predetermined inner diameter, and is set to have a predetermined axial length. By axially continuously disposing the 8 magnet pieces **122***a*, the magnet **122** having a ring shape (or an arch shape) is constructed, and this magnet **122** is pressed onto (caused to adhere to) the outer circumferential surface of the iron core **121** to be integrally fixed. In the magnet **122** made up of the 8 magnet pieces **122***a*, an axial length is set to be slightly larger than that of the iron core **121**.

The retaining ring **123** is made up of a plurality of (in the present embodiment, 8) retaining ring pieces **123***a* having the same shape. Each of these retaining ring pieces **123***a* has a ring shape, is set to have a predetermined outer diameter and a predetermined inner diameter, and set to have a predetermined axial length. By axially continuously disposing the 8 retaining ring pieces **123***a*, the retaining ring **123** having a ring shape is constructed, and this retaining ring **123** is pressed onto (caused to adhere to) the outer circumferential surface of the magnet **122** to be integrally fixed. The retaining ring **123** made up of the 8 retaining ring pieces **123***a* is set to have an axial length slightly larger than that of the iron core **121**, and the same as that of the magnet **122**.

In this case, the magnet **122** and the retaining ring **123** have the same axial length and the same number of divisions, which conforms division positions, that is, contact positions between the magnet pieces **122***a* and contact positions between the retaining ring pieces **123***a*. However, the present embodiment is not limited to this constitution, the axial division positions in the magnet **122** and the retaining ring **123** may be made different. For example, while the magnet **122** and the retaining ring **123** have the same axial length, the numbers of divisions of both are made different, by which the division positions can be made different. That is, the magnet **122** may be made up of the 8 pieces, and the retaining ring **123** may be made up of the 7 pieces.

On the other hand, the stator **113** is made up of an iron core **131**, which is axially divided into a plurality of pieces, and has a ring shape, and a coil **132** wound around a slot portion of this iron core **131**. That is, the iron core **131** has a cylindrical shape with a slot, and is fixed inside a case having a cylindrical shape (not illustrated). In this case, although not illustrated, the iron core **131** is made up of a plurality of thin plate pieces having the same shape. Each of these thin plate pieces has a disk shape with a slot, is set to have a predetermined outer diameter and a predetermined inner diameter, and is set to have a predetermined axial thickness. By axially (thickness-wise) continuously disposing the plurality of disk pieces, the iron core **131**, having a ring shape, is constructed. The iron core **131** made up of the plurality of thin plate pieces is set to have the same axial length as that of the magnet **122** and the retaining ring **123** of the rotor **112**.

Moreover, the coil **132** is wound inside the iron core **131** by a predetermined number of times. This number of turns of the coil is set, based on a power generator required specification voltage. For example, while if the axial length of the power generator **20** becomes twice, the number of turns of the coil may be doubled, but a current is ½, and thus, if joule loss is made equal, a coil wire diameter becomes ½, so that a radial dimension does not change.

In the power generator **20** constructed in this manner, the axial length of the rotor **112** and the stator **113** is set, based on a power generator required specification set, using, as references, the rotation speed of the turbocharger **14** and the output that the power generator **20** can generate. That is, if the output of the power generator **20** is P, a torque is T, and an angular speed is ω, P=T*ω, and the angular speed ω is proportional to a rotation speed N. Thus, since the output P and the angular speed ω (the rotation speed N) of the power generator **20** are set as the power generator required specification, the torque T needs to be adjusted to thereby satisfy this power generator required specification. Here, since the torque T can be replaced by a volume (capacity) of the power generator, the adjustment of the torque T is enabled by changing the outer diameter and the axial length of the power generator **20**, that is, those of the rotor **112** and the stator **113**. In the present embodiment, by changing the axial length of the rotor **112** and the stator **113** without changing the outer diameters thereof, the torque T can be adjusted, which enables various power generator required specifications to be addressed.

That is, the magnet piece **122***a* in the magnet **122**, the retaining ring piece **123***a* in the retaining ring **123**, and the disk piece in the iron core **131** are each set as one unit, and the numbers of pieces are set in accordance with the respective axial lengths. That is, one type of the magnet pieces **122***a*, one type of the retaining ring pieces **123***a*, one type of the disk pieces are only manufactured, and the respective numbers of pieces are set, based on the power generator required specification, so that the desired magnet **122**, the retaining ring **123**, the iron core **131** corresponding to the power generator required specification can be manufactured.

In the magnet **122**, the retaining ring **123**, and the iron core **131**, the axial lengths of the magnet piece **122***a*, the retaining ring piece **123***a*, and the disk piece may be set as needed, and the plurality types of axial lengths may be provided in accordance with the applied power generator, so that the magnet **122**, the retaining ring **123** and the iron core **131** having the different axial lengths may be combined.

In this manner, the power generation facility of the first embodiment is provided with the plurality of diesel engines **11**, **31**, the plurality of turbochargers **14**, **34** driven by the exhaust gas of the plurality of diesel engines **11**, **31**, the plurality of power generators **20**, **40** connected to the plurality of turbochargers **14**, **34**, the plurality of converters **22**, **42** that convert the AC power generated by the plurality of power generators **20**, **40** to the DC power, the one inverter **24** that converts the DC power outputted from the plurality of converters **22**, **42** to the AC power, and the main controller **54** that controls the converters **22**, **42** in accordance with the AC power from the inverter **24**.

Accordingly, the only one inverter **24** suffices as the electric power converter **51**, which enables simplification of the configuration, space saving, and low cost. Moreover, the converters **22**, **42** are controlled in accordance with the AC power from the inverter **24**, by which the stable electric power can be generated.

Moreover, the power generator of the first embodiment is made up of the rotary shaft **111**, the rotor **112** fixed to this rotary shaft **111**, and the stator **113** provided outside the rotor **112**, and the rotor **112** is made up of the iron core **121** fixed to the rotary shaft **111**, the magnet **122** fixed to the outer circumferential surface of the iron core **121** and axially divided into the plurality of pieces, and the retaining ring **123** arranged on the outer circumferential surface of the magnet **122** and axially divided into the plurality of pieces.

Accordingly, the magnet **122** and the retaining ring **123** making up the rotor **112** are constructed by being axially divided into the plurality of pieces, by which in accordance with the power generator required specification, the outer diameters of the magnet **122** and the retaining ring **123** are uniform, and on the other hand, the axial lengths only need to be set, using the predetermined numbers of the divided pieces **122***a*, **123***a*, so that the standardization of the various components can be achieved, thereby enabling low cost.

Moreover, in the power generator of the first embodiment, the magnet **122** has a ring shape (or arch shape) and the plurality of magnet pieces **122***a* having the same outer diameter and axial length are provided, and the retaining ring **123** has a ring shape and the plurality of retaining ring pieces **123***a* having the same outer diameter and axial length are provided to be fitted and fixed onto the outer circumferential surface of the magnet **122**. Accordingly, the magnet **122** and the retaining ring **123** making up the rotor **112** are constructed by lining up the plurality of pieces **122***a*, **123***a* each having the same length, by which the numbers of pieces only need to be set in accordance with the required specification of the power generators **20**, **40**, so that the standardization of the various components can be achieved, thereby enabling low cost.

Moreover, in the power generator of the first embodiment, between the magnet **122** and the retaining ring **123**, the division positions in the axial direction are different. Accordingly, making the division positions of the retaining ring **123** different from the division positions of the magnet **122** enables robust fixing of the magnet **122** by the retaining ring **123**.

Moreover, in the power generator of the first embodiment, the stator **113** is made up of the iron core **131** axially divided into the plurality of pieces and having a ring shape, and the coil **132** wound around this iron core **131**. Accordingly, not only the rotor **112** but also the iron core **131** of the stator **113** is axially divided into the plurality of pieces to be constructed, by which in accordance with the required specification of the power generators **20**, **40**, the outer diameter of the iron core **131** is uniform, and on the other hand, the number of divided thin plate pieces only needs to be a predetermined number to set the axial length, so that the standardization of the various components can be achieved, thereby enabling low cost.

Second Embodiment

FIG. **4** is a schematic configuration diagram of a power generation facility to which a power generator according to a second embodiment of the present invention is applied. Members having similar functions to those in the above-described embodiment are given the same reference numerals, and detailed descriptions thereof are omitted.

As illustrated in FIG. **4**, the power generation facility of the second embodiment has two diesel engines **11**, **31**, two turbochargers **61**, **71**, power generators **20**, **40**, and an electric power converter **51**.

Here, the turbochargers **61**, **71** of the present embodiment are mounted on the respective diesel engines **11**, **31**, and are constructed by connecting turbines **15**, **35** and compressors **16**, **36** via rotary shafts **17**, **37**. Moreover, these turbochargers **61**, **71** are variable capacity type turbochargers, and variable nozzle mechanisms (nozzle vanes) **62**, **72** that can control a capacity of exhaust gas brought to the turbines **15**, **35** are provided. In each of these variable nozzle mechanisms **62**, **72**, although not illustrated, an actuator is driven to rotate a drive ring to thereby swing a lever plate and change a blade angle of the nozzle vane, which enables the capacity of the exhaust gas brought to the turbines **15**, **35** to be adjusted.

Accordingly, in the respective turbochargers **61**, **71**, when the respective turbines **15**, **35** are rotated by the exhaust gas exhausted from exhaust passages **18**, **38** of the respective diesel engines **11**, **31**, the respective compressors **16**, **36** connected via the rotary shafts **17**, **37** are rotated to thereby perform supercharging, which enables the air to be sent into intake passages **19**, **39** of the respective diesel engines **11**, **31**. At this time, the capacity of the exhaust gas to be brought to the turbines **15**, **35** is adjusted by the variable nozzle mechanisms **62**, **72**, so that an intake amount sent into the respective diesel engines **11**, **31**, that is, supercharging pressure can be adjusted.

The respective turbochargers **61**, **71** have the power generators **20**, **40** coaxially connected thereto. In these power generators **20**, **40**, rotary shafts **21**, **41** thereof are directly connected to the rotary shafts **17**, **37** of the respective turbochargers **61**, **71**. Accordingly, when the respective turbochargers **61**, **71** are driven, the respective power generators **20**, **40** can output AC power.

The electric power converter **51** rectifies and outputs electric power generated by the respective power generators **20**, **40**, and has converters **22**, **42**, a DC link **23**, and an inverter **24**. The inverter **24** is connected to an output system **26**, to which a plurality of auxiliary machines **27**, **28**, **29**, . . . are connected.

A converter controller **52** can control the respective converters **22**, **42**, and an inverter controller **53** can control the inverter **24**. A main controller **54** can control the converter controller **52** and the inverter controller **53**, and can control the respective diesel engines **11**, **31**, and the respective turbochargers **61**, **71** (variable nozzle mechanisms **62**, **72**).

Accordingly, the main controller **54** outputs a DC bus voltage command to the converter controller **52**, and outputs a power generation output command to the inverter controller **53**. Here, while the inverter controller **53** performs control of the electric power outputted by the inverter **24**, based on the power generation output command from the main controller **54**, since the electric power from the two converters **22**, **42** is supplied to the inverter **24**, the converter controller **52** controls the respective converters **22**, **42** so that a DC bus voltage becomes constant.

Moreover, in the present embodiment, the main controller **54** controls the diesel engines **11**, **31** and the turbochargers **61**, **71** (the variable nozzle mechanisms **62**, **72**) in accordance with the AC power outputted from the inverter **24**. That is, the main controller **54** controls the diesel engines **11**, **31** and the variable nozzle mechanisms **62**, **72** of the turbochargers **61**, **71** so that the AC power outputted from the inverter **24** becomes almost constant.

That is, the main controller **54** controls the inverter controller **53** and the converter controller **52** so that the AC power outputted from the inverter **24** becomes almost constant. However, since driving force of the diesel engines **11**, **31** is also used for propulsion power of the vessel, fluctuation in the driving force causes fluctuation in the rotation speed of the power generators **20**, **40**, that is, the power generation amount.

Thus, the main controller **54** controls the diesel engines **11**, **31** within a range where the propulsion force of the vessel does not fluctuate so that the rotation speed of the power generators **20**, **40** does not fluctuate. These control contents of the diesel engines **11**, **31** include, for example, an intake air amount, a fuel supply amount, ignition timing, the rotation speed and the like.

Moreover, the main controller **54** controls the supercharging pressure in the turbochargers **61**, **71** within the range where the propulsion force of the vessel does not fluctuate so that the rotation speed of the power generators **20**, **40** does not fluctuate. That is, the main controller **54** adjusts the capacity of the exhaust gas brought to the turbines **15**, **35** by the variable nozzle mechanisms **62**, **72** to thereby adjust the intake amount sent to the respective diesel engines **11**, **31**, that is, the supercharging pressure.

Although the above-described turbochargers **61**, **71** are of a variable capacity type, the other configurations are similar to those of the first embodiment, in which the power generators **20**, **40** are contained inside. Rotary shafts of these power generators **20**, **40** are directly connected to the rotary shafts **17**, **37** of the turbochargers **61**, **71** integrally rotatably, and the other configurations are similar to those of the first embodiment.

In this manner, the power generation facility of the second embodiment is provided with the plurality of diesel engines **11**, **31**, the plurality of turbochargers **61**, **71** driven by the exhaust gas of the plurality of diesel engines **11 31**, the plurality of power generators **20**, **40** connected to the plurality of turbochargers **61**, **71**, the plurality of converters **22**, **42** that convert the AC power generated by the plurality of power generators **20**, **40** to the DC power, the one inverter **24** that converts the DC power outputted from the plurality of converters **22**, **42** to the AC power, and the main controller **54** that controls the converters **22**, **42** in accordance with the AC power from the inverter **24**.

Accordingly, the only one inverter **24** suffices as the electric power converter **51**, which enables simplification of configuration, space saving and low cost. Moreover, the converters **22**, **42** are controlled in accordance with the AC power from the inverter **24**, by which the stable electric power can be generated.

Moreover, in the power generation facility of the second embodiment, the main controller **54** controls the plurality of diesel engines **11**, **31** and the plurality of turbochargers **61**, **71** in accordance with the AC power from the inverter **24**. Accordingly, the diesel engines **11**, **31** and the turbochargers **61**, **71** are controlled so that the AC current power from the inverter **24** becomes desired electric power, which enables the stable electric power to be generated.

In this case, the main controller **54** controls the intake air amount, the fuel supply amount, the ignition timing, the rotation speed and the like of the diesel engines **11**, **31**, which enables the stable electric power to be generated. Moreover, since the turbochargers **61**, **71** are of the variable capacity type, the main controller **54** controls the variable nozzle mechanisms **62**, **72** in the turbochargers **61**, **71** to thereby adjust the supercharging pressure, and thus, the exhaust gas amount, flow velocity and the like are adjusted to thereby control the supercharging pressure, by which the stable electric power can be generated.

While in the power generation facility of each of the above-described embodiments, the two diesel engines **11**, **31** are applied as the plurality of exhaust gas generating sources, and the two turbochargers **14**, **34** or **61**, **71** are provided, the number of them are not limited to two, but may be three or more. Moreover, the exhaust gas generating sources are not limited to the diesel engines, but may be respective cylinders in these diesel engines, and the turbocharger may be arranged in each of the cylinders. Furthermore, the exhaust gas generating sources are not limited to the diesel engines, but only need to be ones that generate the exhaust gas, and may be gas turbines or the like.

The power generator according to the present invention achieves standardization of various components by axially dividing the rotor, thereby enabling low cost, and can be applied to any power generator and power generation facility.

REFERENCE NUMERALS LIST

11, **31** diesel engine (exhaust gas generating source)
14, **34**, **61**, **71** turbocharger
20, **40** power generator
22, **42** converter
23 DC link
24 inverter
51 electric power converter
52 converter controller
53 inverter controller
54 main controller
111 rotary shaft
112 rotor
113 stator
121 iron core
122 magnet
122*a* magnet piece (divided piece)
123 retaining ring
123*a* retaining ring piece (divided piece)
131 iron core
132 coil

The invention claimed is:

1. A power generation facility comprising:
a first exhaust gas generating source;
a second exhaust gas generating source;
a first turbocharger driven by exhaust gas from the first exhaust gas generating source;
a second turbocharger driven by exhaust gas from the second exhaust gas generating source;
a first power generator connected to the first turbocharger;
a second power generator connected to the second turbocharger;
a first converter for converting AC power generated by the first power generator to DC power;
a second converter for converting AC power generated by the second power generator to DC power;
one inverter for converting the DC power outputted from the first and second converters to AC power; and
a control device for controlling the first and second exhaust gas generating sources or the first and second turbochargers in accordance with the AC power from the inverter,
wherein the first exhaust gas generating source, the first turbocharger, the first power generator and the first converter configure a first group,
the second exhaust gas generating source, the second turbocharger, the second power generator and the second converter configure a second group, and
the first group and the second group are arranged in parallel.

2. The power generation facility according to claim **1**, wherein the plurality of exhaust gas generating sources are engines, and the control device is configured to control the engines so that the AC power from the inverter becomes constant.

3. The power generation facility according to claim **1**, wherein the plurality of turbochargers are variable capacity type turbochargers, and the control device is configured to control supercharging pressure in the turbochargers so that the AC power from the inverter becomes constant.

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